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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS

FOREST PRODUCTS

FOREST ECONOMICS

RANGE RESEARCH

1931
DEC 1931



BRANCH OF RESEARCH

December, 1931

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HIGHLIGHTS

<u>Station</u>	<u>Paragraph Heading</u>	<u>Subject</u>
Appalachian	Methods of Cutting	Sample Plot Technique
Appalachian	Pathology	Insects and Blue Stain
California	Woods and Mill Study	Economic Tree Diameters
Central States	Locust Borer	Number of infestations.
Intermountain	<u>Entire Report</u>	
Northern Rocky Mt.	<u>Entire Report</u>	
Southwestern	Sample Plots	Mortality
Region 2		Thinning in Lodge-pole Pine.

(over)

ALLEGHENY FOREST EXPERIMENT STATION

Forestation

Survival of the conifers underplanted in 8-year old sprout hardwood stands at Camp Ockanickon is shown in the following tables:

1930 Plantings

Species	Total Planted : 1930	April 1930 : Alive	August 1930 : Sur- vival	April 1931 : Alive	November 1931 : Sur- vival
		%	%	%	%
Shortleaf Pine	1000	590	59.0	422	42.2
White Pine	495	485	97.9	394	79.6
Red Pine	514	514	100.0	454	88.3
Jack Pine	705	615	77.4	464	58.4
Pitch Pine	605	574	94.9	428	70.7
All species	3409	2778	81.4	2162	63.5

1931 Plantings

Species	No. planted : April 1931	No. alive : November 1931	Per cent : Survival
Shortleaf Pine	348	242	69.5
Red Pine	1010	671	66.5
Loblolly Pine, N.J.	424	219	51.7
" " Md.	1010	886	87.7
Pitch Pine	554	390	70.4
All Species	3346	2408	72.0

The above tables seem to reflect the greater severity of the summer drought of 1931 in south Jersey as compared with that of 1930. Total rainfall during 1931 was only 37.75 inches, or 9.77 inches below normal. This was only slightly more rain than in 1930, a year of record drought

elsewhere. Moreover the 1930 rainfall was better distributed, especially during the summer months. The native species seem to have withstood the drought of 1931 better than the exotic ones. In the 1931 plantations the Maryland loblolly pine is the outstanding species. The New Jersey loblolly was poor when planted, as were the red and shortleaf pines. The red pine was small, and the shortleaf showed frost injury. Growth summaries for 1931 have not been completed, but for the 1930 plantations the relation between initial height when planted and 1931 growth is still apparent. This relationship is not so marked for the 1931 plantations.

Measurements

Schnur continued to analyze the diameter distributions of the loblolly pine plots. He thus summarizes his impressions of the annual meeting of the American Statistical Association:

"The general trend of all meetings and papers is toward a common-sense analysis of field data before applying statistical methods. Statistics are a good slave but a poor master. If statistical methods are applied in a sensible and correct manner the results will be sensible and correct. But great errors are possible if they are used erroneously."

We hope that the loblolly study will not require Schnur's attention beyond the first of July, and must make a choice of two jobs after that date. The first is a study of the yield of northern hardwoods, a project of great importance in connection with our intensive study of the management of this type. The alternative is completion of the oak yield study which is "nobody's baby" now that McCarthy has left the Service. If we undertake this job, Schnur will have to write the text to accompany the volume and yield tables for the eastern oaks, and would hope to follow up the study by establishing a large number of permanent yield plots in the oak type in our territory. Lack of Federally-owned land in this type presents a serious problem.

Mycorrhiza

Hatch returned from his furlough at Harvard the middle of the month, and has been assisting Doak in handling the material collected during the field season of 1931. The work so far accomplished is as follows:

1. Cleaning 54 collections (some embracing 14 separate samples) of mycorrhiza from various parts of the Allegheny region and from many tree species.

2. Commencing to dehydrate the mycorrhiza preparatory to embedding and sectionizing.

3. Selection of about 45 mycorrhiza samples for photographing, and photographing about one-third of these at magnifications of from 8.5 to 13.

In all there are about 450 collections, most of which contain between 2 and 10 separate mycorrhizal samples. Handling of the remainder of the field collections with similar thoroughness is obviously a tremendous task. So far it has not been possible for either of the cooperating agencies to hire a technical laboratory assistant to do some of the routine work.

Types

Forbes did what he expects will be his final work for the Eastern Type Committee, Society of American Foresters, when he reviewed the type descriptions for the 97 types proposed by Hawley's committee. Hawley's types have been so arranged that it has been possible, with only two or three exceptions, to distinguish the much broader types which the Allegheny Section Committee would prefer to recognize within its own territory, simply by bracketing together two or more of the 97 types on Hawley's list. We feel that the Committee's labors have been extremely fruitful.

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APPALACHIAN FOREST EXPERIMENT STATION

Methods of Cutting

During December preparations were made for the regular yearly cuttings on the Bent Creek Forest, where last winter operations were carried on in Compartments 1 and 2. The upper half of Compartment 3 was previously set aside as a check area to be left uncut. This winter the 20 acres in the lower half of this compartment will be cut over. The first job was to divide the area into two units, designated 3a and 3b.

Unit 3a covers an acre and a half in the cove hardwoods type on a small delta where two streams enter Bent Creek. The stand is largely red maple with a few oaks, hickories and pines. An understory of rhododendron and laurel covers about three-fourths of the ground and is very dense over half of the area. Three large yellow poplar seed trees stand at about the center of the unit, but very little yellow poplar reproduction has come up on it.

The stand will be clear cut except for yellow poplar, in an attempt to reproduce that species throughout the unit. Except for the heavy laurel cover the conditions resemble those of an area treated by

McCarthy in 1925 in a study of yellow poplar reproduction. His clear cut area grew up to a dense cover of ferns, and they are blamed for the almost complete failure of yellow poplar reproduction. Consequently unit 3a will be carefully watched after the cutting, and if there is likely to be a repetition of the happenings on the McCarthy cutting this will be made a subject for further experimentation.

The stand on the 18 acres of unit 3b is a mixture of pine and hardwoods. On the ridges the pines are dominant over the hardwoods, but in the intervening draws the hardwoods have competed successfully with them, and in some places have excluded them altogether.

This area has been marked according to a scheme which Dr. C. A. Schenck used on the Biltmore Estate in similar stands about 1905. He concluded that such sites are better suited for the production of pine than of hardwood lumber, but he also knew that the hardwoods could not be eliminated without a great deal of expense. Therefore he decided to cut the hardwoods for fuel on a thirty-year rotation, and to let the pines grow for lumber, to be cut on a rotation which should be some multiple of this thirty year rotation for the oaks. This scheme is modeled after the French "standards with coppice" system.

The stand on unit 3b is naturally irregular and in order to bring it under Dr. Schenck's cutting scheme an average per acre of forty standards of pine and of hardwoods (where the pine was lacking) were marked to be left. All the remaining merchantable stand will be removed for firewood, and then possibly a cleaning will be made in the advanced reproduction which is too small for firewood. After these treatments conditions should be favorable for this advanced reproduction under the pine and hardwood standards to grow into future standards as the cutting system progresses.

It is the regular practice on the experimental forest to make more complete and intensive observations on sample plots covering about 10 per cent of the area of each treated unit. Accordingly four one-half acre sample plots, each 2 x 2.5 chains, were established, one in unit 3a and 3 in unit 3b.

Certain details of the technique of plot establishment which were used this winter may be of interest.

Swellings are often produced about nails driven into hardwood trees. On these plots tags were nailed a foot above breast height so that later diameter measurements would not be distorted. A cross of white paint was made at B. H.

To map the stems of trees on the plots, a network of strings 1/2 chain apart each way was used. A chain tape was stretched through the middle of each successive 1/2 chain square, and the position of each tree measured from this tape with a long measuring stick. In the same way the shade of rhododendron and laurel clumps was charted. Contour maps were made by reading elevations with an Abney at all corners of the 1/2 chain squares.

In order to simplify the representation of species by symbols on the stem map, all species were thrown into five groups, each with a key symbol which can be varied to represent individual species within the group. The species groups and key symbols are as follows:

<u>Species group</u>	<u>Key symbol</u>
White oaks	Circle
Red oaks	Triangle
Other desirable hardwoods	Square
Less desirable hardwoods	Cross
Conifers	Diamond

Thus, Post oak is shown by a circle with a horizontal diameter line through it; yellow poplar, by a square with a vertical line through it; dogwood by a cross with a dot below it; and white pine by a diamond with a dot in the middle of it.

A summary of the time required to establish the 4 half-acre sample plots using 2 two-man crews, all of them experienced workers, follows:

Surveying, including temporary location and final survey	8 $\frac{1}{2}$ man days
Tagging and describing 774 trees	9 $\frac{1}{2}$ " "
Mapping tree stems and rhododendron and laurel shade	8 $\frac{1}{2}$ " "
Topographic maps	4 " "
Painting B.H. points on 71 trees to be left, painting boundaries, witness trees, etc.	3 $\frac{1}{2}$ " "

In this region sample plots are usually established during the summer. An advantage of winter work over summer is that time is saved in plot surveying and stem mapping when the leaves are down. The disadvantages are that leafless reproduction is hard to find and to identify, and the weather may hold up the work. On this particular job no attempt was made to count reproduction, and the weather was unseasonably balmy.

Georgia

Computation of the stand and growth data, taken during November, for the 180 acres of woodland on the Georgia Mountain Experiment Station was completed during the month. This woodland is typical of the

farm timberlots which form a large proportion of the valley farms in North Georgia. The past history of these stands, repeated burnings and cullings, is reflected in the low volume and growth shown in the table below.

Forest type	Merchantable cubic feet per acre			
	Present	Volume	Growth in	Annual
	living	10 years		
	volume	ago	last decade	growth
Scarlet Oak-black oak-	:	:	:	:
white oak	: 849.7	: 507.5	: 342.2	: 34.22
Black jack oak-post oak	:	:	:	:
- scarlet oak	: 747.8	: 477.9	: 269.9	: 26.99
So. red oak-black oak-	:	:	:	:
white oak	: 837.8	: 522.1	: 315.7	: 31.57
Chestnut oak-black oak-	:	:	:	:
scarlet oak	: 963.4	: 600.6	: 362.9	: 36.29
So. red oak-post oak-	:	:	:	:
scarlet oak	: 799.0	: 459.3	: 339.7	: 33.97
Red maple-yellow poplar	:	:	:	:
- white ash	: 664.2	: 387.7	: 276.5	: 27.65
White oak-black oak-	:	:	:	:
chestnut oak	: 689.9	: 434.8	: 255.1	: 25.51
Hickory-chestnut oak	: 1086.6	: 679.0	: 407.6	: 40.76
:	:	:	:	:

The above values are based on the total volume, including bark, to a 4 inch top of all trees of the 4 inch d.b.h. class and greater. A stump height of 1 foot was used in the computations.

Using 90 cubic feet per cord as a converting factor, the annual growth for the entire 180 acres in the tract averaged only 0.36 cords per acre. The maximum growth per acre per year, 0.45 cords, was found in the hickory-chestnut oak type and the lowest, 0.28 cords in the white oak-black oak-chestnut oak type. In addition to the living trees, an average of one-half cord per acre of dead wood usable for fuel is present on the tract.

Director Stuckey of the Georgia Experiment Station expects to use the data gathered in the growth study as the basis for a management plan for the area. Material cut will be used in filling a contract to furnish fuel for a local consolidated high school. As the cutting progresses over the tract, our station will have excellent opportunities to install permanent sample plots in the various types and units.

Forest Influences

Preliminary observations were made on a small surface runoff plot installed on a lower north slope at Bent Creek. The plot is on a soil of friable crumb structure under a rapidly decomposing hardwood litter and has a gradient of 70 per cent. No measurable amounts of runoff or ero-

sion occurred during December although the area had been clear cut in the spring of 1931. These preliminary observations strengthen the conclusion that a loose, friable, highly organic forest loam has a sufficiently high index of porosity to prevent surface runoff and erosion even on slopes of considerable steepness. Collection of data for further standardization of the trough rain gauge being tried out at Bont Creek was also continued during the month.

Pathology

Nelson completed a paper summarizing his experiments with blue stain fungi in pine carried on during the past four years. The studies lead to the following conclusions:

1. Pines successfully attacked by the Southern pine beetle invariably become bluestained before death which occurs within a few weeks after attack.
2. This constant association of insects and fungi, together with the phenomenon of specificity, - the association of a specific blue staining organism with a specific bark beetle - indicates that the insects carry the blue staining fungi into their tunnels and thus inoculate the infested trees.
3. The fungi grow chiefly in the ray parenchyma cells and resin ducts; to a lesser extent in the wood and ray tracheids.
4. Stained sectors in the sapwood block the upward flow of the transpiration current. The water content of the bole is thus reduced, a condition which apparently is necessary for proper beetle brood development.
5. There is some evidence that the action of the fungi in the rays causes aspiration of the tori in the bordered pits of the water conducting tracheids and thus excludes them from the conducting system.
6. Tunnels made by bark beetles are sufficient to kill pines in time, but the immediate cause of death is due to the action of associated blue stain fungi.

Biology

Late in the month a male beaver from Pennsylvania was added to the colony on the Biltmore Estate. Of the three females planted during November, two have made themselves at home in the lake chosen for them, while the third has wandered rather widely. She has been reported seen over a mile from the pond. The beavers remaining at the pond have settled down to work and have been actively cutting trees, an activity rather perturbing to the landscape department of the estate.

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CALIFORNIA FOREST EXPERIMENT STATION

Forest Management - Pine Region

During the month Hazel continued work on the preparation of progress reports for the Mc plots which were remeasured during the 1930 field season. Computations were finished and tables and graphs prepared for Sequoia Plots 3, 4, and 5. The progress report for Sequoia Plot 3 was completed. An article was prepared for publication on the growth results on Sierra Mc Plot 1.

On checked computations on Mc plots, including Plumas Plot 1, Stanislaus Plot 3, and Shasta Plots 6 and 11. Particular attention was paid in computing average heights by diameter groups to include only trees for which heights were taken at each period in order to keep periodic height growth on a comparable basis.

Forest Management - Redwood Region

Person and Gibbs both spent most of the month in the office working on the analysis of data collected on the study of redwood cut over areas. After consultation with Brundage and Mason, who have had considerable experience with the Hollerith tabulating machine, and a representative of the International Business Machines Corporation, it was decided to use a tabulating machine for studying the cutover area data. A card has been designed and arrangements are now being made for printing. A form for coding all of the data has been prepared and Gibbs has completed the coding of nearly half of the field records.

Person made a trip to Ft. Bragg, where he was able to get a copy of a base map which was prepared by Davis, formerly of the Union Lumber Company. This map will be used in the preparation of a map of Mendocino County, which will be used by Wieslander in mapping the cover type. No U. S. G. S. topographic sheets are available for any of the north coast

counties. As a result of interviews with Mr. C. R. Johnson and Mr. Otis Johnson, President and Manager, respectively, of the Union Lumber Company, permission has been granted to abstract all type data desired direct from cruising records of this company. As the Union Lumber Company is the largest operating company in Mendocino County, their cooperation will be of considerable help in the preparation of the cover type map for this county.

Cover Types

The establishment of state work camps to care for the transient unemployed has resulted in a serious disruption of the winter program of work. Three state rangers assigned to the type map project for the winter and spring months have been detailed instead to supervisory duties in these camps. This takes Clar away from the task which he had well under way of collecting and compiling type data made available by the lumber companies in the Redwood Region. It will also prevent Rangers Raymond and Phelps from typing Monterey and San Benito counties.

U. S. G. S. Cooperation

Some two years ago the Division Engineer of the U. S. G. S., stationed at Sacramento, agreed to cooperate in the typing of National Forest areas in connection with the preparation of topographic quadrangles. The initial attempt on the Hoaglin quadrangle, Trinity National Forest, in 1930 was not very encouraging. The types were confused and it was apparent that more data were requested than could be reasonably expected. This led to revised instructions providing for the mapping of only the obvious or major types, such as timber, brush, dense woodland, open woodland, grass, etc., with a great deal of stress laid on accuracy of mapping. The field parties were visited and the types pointed out on the ground.

A total area of over 2000 sq. miles were mapped and the results have been gratifying. Jensen made a field check of work in progress on the Hoaglin and found it very accurate. Type data recently received for two 30 minute quadrangles, the Etna Mills and the Sisson, largely within the Shasta National Forest, indicate work of the same excellent quality. Since the major types coincide with the main fire hazard zones the data will be of value to the Forest Supervisor this coming fire season. With these data the field work necessary to secure data on species, sites, stocking of burns and cut-overs, etc. should be speeded up at least 50 per cent.

Recently in discussing the results of this work with Mr. Hodgeson, Division Engineer of the U. S. G. S., Wieslander suggested that similar data be secured on all future quadrangles outside of National Forests as well as inside. As a result, Mr. Hodgeson sent out instructions to this effect to all field engineers.

Erosion and Streamflow

Unusual Precipitation in December

Whether the unusually heavy precipitation of December in California presages a wet year is a matter for long range forecasters to answer. The seasonal fall to date of over 16 inches in the Bay region is double the average fall of slightly more than 8 inches, whereas last year the rainfall at this time (January 1) was only 2.75 inches. Snow lies on the Sierras to depths that bring satisfaction to water users in the valleys. Streams are running full. Successive invasions of low pressures over California from December 22 to January 1 brought a total of 10.25 inches of rain on our Strawberry tank and run-off installations at Berkeley.

The copious rains thus far suggest a reference to predictions of rain for California for the winter of 1931-1932. A publication of the Scripps Institution of Oceanography, La Jolla, California, entitled "Indicated Seasonal Precipitation for 1931-1932 in Selected Regions of California", states the conclusion that calculations of the composite index indicate for 1931-1932 a seasonal deficiency of 2.3 inches for the South Coastal region and 4.1 inches for the Santa Barbara region.

In contrast to this prediction, however, is a suggestion which may possibly be drawn from the precipitation records at Henderson Lake, Vancouver, B. C., by F. Napier Denison, of the Canadian Meteorological Service. The precipitation during the first four months of the year 1931 was 154.89 inches - which represents an abnormal fall for that period of the year at Henderson Lake and presages, according to Napier's studies, precipitation above normal in British Columbia. If rainfall at Henderson Lake also presages the departures of rainfall in California from the mean, a valuable forecasting guide will have been discovered.

Measuring Water

The problem of measuring streamflow accurately perennially confronts the investigator of the influences of forest vegetation on streamflow. The use of the Parshall flume, with a slight adaptation to mountain stream conditions, was referred to by Lowdermilk in a former issue of these reports. It may be of interest to report here another meter which has recently come to our notice and which we propose to test against the Parshall flume under certain conditions. The instrument employs the principle of a submerged orifice without bottom contraction. The device is simple in design and construction. The patented part of it is a meter which measures the difference in head, and records on a dial the cumulative total. Provision is not made for recording rate of flow, but cumulative totals of flow are read and calculated by a simple factor. The device has special promise in streams not heavily laden with coarse debris.

Information on this equipment may be had from the Great Western Meter Company, 1290 Powell Street, Oakland, California.

New Committee of Section of Hydrology of American Geophysical Union

Dr. O. E. Meinzer, Chairman of the Section of Hydrology of the American Geophysical Union, recently appointed a committee of members to cover the subjects of infiltration and transpiration. Doctor Lowdermilk of the Station staff was appointed by Doctor Meinzer to serve on the Committee, which consists of the following persons:

Charles H. Lee, Chairman, Harry F. Blaney, Lynn Crandall, S. T. Harding, W. C. Lowdermilk, B. E. Livingston, John E. Weaver, W. N. White.

Range Research

The Section of Range Research now consists of three men: Talbot, Renner, and Hormay. Most of their effective time during the month was devoted to the gathering of information on grazing conditions and grazing problems in the foothills of the eastern side of the San Joaquin Valley.

A chief aim of the Section, this winter, is a careful size-up of these foothills, as a foundation for the later establishment of intensive experiments. In connection with this "scouting" thirteen temporary plots previously had been located in different types of vegetation and at different elevations, along the "fronts" of the Stanislaus, Sierra, and Sequoia Forests. These plots were examined and observations were recorded on such points as the comparative beginning of growth, rate of growth, and palatability, of the important range plants. These temporary plots, or observation stations, will yield useful information on these and on numerous other points relating to grazing.

About one-third of the month was required by Mr. Renner, for the completion of his report entitled "Erosion on the Boise River Watershed as affected by Various Biotic and Physiographic Factors". This report gives the results of a detailed study of an area of about 400,000 acres, a study completed by Mr. Renner before he was transferred from the Intermountain Forest and Ranger Experiment Station.

Fire Research

(Statement on Binoculars used in Service Bulletin).

Equipment

In an attempt to find power driven apparatus which will be useful in cutting fire lines in heavy brush, a circular, electrically driven hand saw made by Black and Decker was tested. It apparently offered possibilities, and it was decided to construct a carriage for its use. This has been done and the outfit is now ready for a second trial. The saw is supported on a two-wheeled carriage with a device for raising the saw from 2" above the ground to a height of 18". The saw will be tried on the Shasta brush fields early next spring.

General

The preparation of the visibility maps for evaluation is progressing satisfactorily. Approximately 30 maps have been checked, inked and traced.

Forest Products

Stanislaus Woods and Mill Study

There is a radical change in the position of the economic tree diameter limit in white fir when top utilization is changed from the usual Forest Service requirement of 10 inches to the economic log diameter limits calculated from the Stanislaus Study data. These log limits were 20" for grades 1 and 2 and a little over 23" for grade 3.

Including only those trees containing at least one economic log, i.e., a log whose value is equal to or greater than the costs of conversion from bucking to shipping shed, inclusive, and in all trees, utilizing only to the 20"-23" diameters, the economic D.B.H. limit moves from 35", the zero margin when 10" tops are taken in, down to 28".

Values per M feet do not change appreciably, the increased marginal values being brought about chiefly by a lowering of the costs which vary with log diameter.

Comparative conversion costs, felling to shipping shed, exclusive of fixed acre costs, are shown below for trees utilized to (1) 10" tops, (2) to Economic top limits.

Costs per M for Logging and Milling White Fir Trees of Different Sizes

D.B.H.	:(1) Full Utilization		:(2) Economic Top Utilization		: Decrease in Cost per M	
					: (2) under (1)	
26	:	\$21.46	:	\$20.01	:	\$1.45
28	:	20.76	:	19.32	:	1.44
30	:	20.19	:	18.87	:	1.32
32	:	19.69	:	18.57	:	1.12
34	:	19.26	:	18.27	:	.99
36	:	18.90	:	18.07	:	.83
38	:	18.62	:	17.93	:	.69

The changes in margins, showing the approximate economic D.B.H. limits under the two different systems of utilization are:

Marginal Values for White Fir Trees, 1928-'29-'30

(Difference between operating costs - exclusive of fixed acre charges, brush disposal and stumpage - and selling values per M feet).

D.B.H.	:(1) 10" Top Utiliz.		:(2) Economic Top Utilization	
	+	-	+	-
26	:	\$ -	:	\$2.05
28	:	-	:	1.39
30	:	-	:	.86
32	:	-	:	.42
34	:	-	:	.05
36	:	.26	:	-
38	:	.49	:	1.09
				1.18

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CENTRAL STATES FOREST EXPERIMENT STATION

Forest Litter Study

During December Auten completed and submitted to Washington for publication a manuscript report on "Porosity and Water Absorption of Forest Soils".

Kuenzel assisted Auten in completing the correlation of litter samples begun in the autumn. Red and white oak, beech, maple, and hickory leaf litter was gathered from characteristic soil areas in Ohio, and a short study of chemical variation of these samples is planned.

Woodland Grazing Study

Day, assisted by Kuenzel, completed the tabulation of data from the fifty odd permanent sample plots established during the past summer in cooperation with the Purdue Agricultural Experiment Station. A considerable portion of these data will be combined with those secured in 1930 and will be incorporated in the report by Day and DenUyl, which is almost ready for publication.

Plantation Studies (Fp-1)

Spacing is recognized as a factor in the growth and form of black walnut trees. The Station has 55 stem measurements, taken in Illinois in 1929 by Hanley and Lucas, on walnut trees grown in an open wind break. These measurements have been checked and curved, and it is planned to compare them with plantation walnuts, in order to determine the differences, if any, in form and growth.

Locust Borer Investigation

Spraying Experiment

Dr. Hall reports that during the first week in December one day was devoted to carrying on a fall spraying experiment for control of the locust borer.

The area selected for this spraying experiment was a severely damaged young stand of locust, 7 years of age, located in southeastern Ohio, a few miles east of Jackson. Fifty trees were tagged and sprayed

and the remainder of the stand was left as a check. Orthodichlorobenzene and kerosene were used as spray materials. The table below gives the kind of spray, concentration and number of trees used.

Number of trees	Spray Material	Concentration
1 to 10 inc.	Orthodichlorobenzene	Ortho. Emuls. (1) Water ($1\frac{1}{2}$)
11 to 25 inc.	"	Ortho. Emuls. (1) Water (3)
36 to 50 inc.	"	Ortho. Emuls. (1) Water (6)
26 to 35 inc.	Kerosene	Kerosene (straight)

During the month of November a number of trees were examined in this stand to find the abundance of young larvae. All the trees examined appeared to be heavily infested. One tree was carefully examined and was found to contain 191 young larvae. A similar examination was made in this stand in December. A 7 year old tree, 2:1 d.b.h. and 15 feet in height was found to contain 217 young larvae. These larvae were distributed in the tree as follows (measurements made from the ground level): first foot - 27 larvae, second foot - 43 larvae, third foot - 61 larvae, fourth foot - 36 larvae, fifth foot - 26 larvae, sixth foot - 12 larvae, seventh foot - 3 larvae, eighth foot - 5 larvae, ninth foot - 4 larvae (total of 217 larvae in nine feet). This tree had been severely injured during previous years and was badly scarred as a result. It was found that a very large proportion of the young larvae was concentrated in and around these old scars.

During the remainder of the month a further compilation of field data has been made. An attempt has been made to correlate the pH of the soil with damage by the locust borer. From the data at hand it appears that there is little or no relationship. Practically all of the present plots occur on soils with an acid reaction, ranging in pH from 4.8 to 7.9. It may be that further plots, taken on more alkaline soils, will demonstrate that such a relationship does exist.

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INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Forest Management

Twenty five-acre western yellow pine permanent sample plots are being coded this winter for the punch card system and the work is progressing exceptionally well. The system of coding seems most efficient and

satisfactory and includes on an 80-column heading, the location of the plot, plot number; tree number; aspect, individual history of the tree, and diameters, basal area, board foot and cubic volume at the respective measurements. Numerous combinations and sorts are being evidenced as the work progresses and a most comprehensive study should be completed when the many suggested sorts are individually analyzed.

The 1931 fire statistics for Region 4 have been compiled completing a 10-year record and are ready for analysis by the punch card system this winter. The need and desirability of this work was particularly stressed at the recent regional fire conference held in Ogden at which time the administrative field force expressed much need for and desire to obtain these compiled and analyzed statistics to assist in both their pre-suppression and suppression problems.

Range Management

Summer Range, Great Basin

Pausing for a moment and reflecting over a portion of the 1931 data with reference to the effect of drought on vegetation, you find a few interesting facts, two of which are flower stalk production and flower stalk height. Taking the data of Agropyron spp. which is represented on three yield plots, one in each of the major types, namely, oak-brush, elevation 6800 to 8000 feet; aspen-fir, elevation 8100 to 9100 feet; and spruce-fir type, elevation 9200 to 10,300, and Bromus polyanthus which occurs at the aspen-fir type, one finds the following comparison of the 1931 data with a 6-year average, including 1931.

Zone	Species	No. of Flow Stalks:		Ht. of Flow er Stalks	
		6-year aver.:	1931	6-year aver.:	1931
Oak-brush	Agropyron spp.	553	758	63	54
Aspen-fir	Agropyron violaceum	2532	1574	54	56
" "	Bromus polyanthus	6802	2436	50	52
Spruce-fir	Agropyron violaceum	* 484	*352	49	36

* Count on a 2-foot strip through plot.

Glancing at the figures of the oak-brush type, we find that during the 1931 season there were more flower stalks produced with less height

than the 6-year average. Looking at the soil moisture data we find that there was 1.02% more soil moisture present in the 0-6" depth, .82% more in the 6-12" depth, and 3.53% more in the 12-24" depth during the early 1931 season when growth began, than the 7-year average; indicating that more stalks may be produced, but later when this moisture was used up, growth was retarded.

In the aspen-fir type, where growth starts a month later, a greatly reduced number of stalks were produced, due to drought which may influence added height growth.

At the spruce-fir type both the average height and the number of flower stalks were reduced. This is due entirely to lack of moisture. Little or no rain came, making the short growing season very critical.

1931 Drought seriously affects the range forage yield

Forage yield records obtained in 1931 on summer range on the Wasatch Plateau in Utah show how a deficiency in summer precipitation may affect forage production.

The main vegetative growth in the aspen-fir and spruce-fir zones occurs during June, July and August, while in the oak brush zone as much as 50 per cent of the growth often occurs in May.

The summer precipitation in 1931 varied from 34 to 68 per cent below the 17-year mean. The greatest deficiency was in the oak brush zone, followed close by the aspen-fir zone. The precipitation in the two lower zones occurred in the form of light showers which were not sufficient to even moisten the soil to any appreciable depth. As a result the vegetation made very little growth and on most areas stopped completely. In spite of the deficient summer precipitation in the oak brush zone the total forage yield was slightly less than 5 per cent below the 8-year average. Undoubtedly there was sufficient available moisture in the soil early in the season to produce this nearly average forage crop.

The effect that deficient summer precipitation has on the forage yield was even more apparent in the two upper vegetative zones. The depletion of the soil moisture by the heavy vegetative cover was rapid. The rainfall was so light and far apart and therefore was not sufficient to replenish the depleted soil moisture. Consequently the vegetation made very little growth and even started to mature at a much earlier date.

As a result of the deficient forage crops, the grazing capacity of the range was greatly reduced and furthermore the range forage was very closely utilized at the end of the growing season. It resulted further in the removal of livestock from the range at an earlier date.

Spring-Fall

Prior to Pickford's leaving for Washington, he and Craddock assembled into rough form a completely revised project plan for the range studies at the U. S. Sheep Experiment Station. The plan was developed by breaking the main project into its logical categories, providing subproject plans for each phase of work, as well as detailed descriptions of methods to be used. The plan likewise provides for a scheme of filing experimental data, as well as the usual administrative correspondence.

It may be of interest to note that the first subproject is "Climate and plant growth", followed by the second subproject "Grazing methods and forage production"; the purpose being to evaluate the influence of climate on forage production before attempting to determine the influence which any system of grazing might exert upon the vegetation.

Winter Range

During the early part of November, Messrs. Hutchings and Crook made a survey of two prospective sites for experimental range studies. Most of the desert range is public domain. Up to the present very little range research has been done on desert ranges anywhere in the West. During the season of 1931 general inspection trips were made over the entire desert area before definite action was taken to select prospective sites for an experimental range. The two sites tentatively selected, Snake Bay and Pine Valley, are located in western Millard County, Utah. Data for the two areas have been compiled, including type maps. The areas of the two sites are as follows: Snake Bay, 69,386, and Pine Valley, 92,161 acres. Both sites contain all the major desert types with the exception of greasewood. In all, 21 types are represented in Snake Bay and 22 in Pine Valley. The two are very similar in composition and vegetative cover except the Snake Bay area has a preponderance of shadscale and ricegrass, with no blue grass, while the Pine Valley area has shadscale, ricegrass, and a large amount of blue grama. The types in Pine Valley are generally larger than those on the Snake Bay area. Forage and vegetation are in very good condition on both areas as a result of little stock water and comparatively light use in the past.

Sheep on the western desert ranges were having a hard time this winter as feed was less than 50 per cent of normal and there are more sheep being wintered out this year. On November 10 and 11, storms occurred which put a blanket of snow over most of the desert area. Immediately after the storm, sheep were started for parts of the desert remote from permanent water, and bands which had been held on the ranches were started for the desert.

Cell Sap Studies

Dr. Geo. Stewart made a trip to St. Paul to the University of Minnesota, in November. Some years ago, the late Dr. J. Arthur Harris, then head of the Botany Department at Minnesota, conducted some studies of plant sap at the Great Basin branch station of the Intermountain Station. Previously Dr. Harris had worked on semidesert vegetation. Some striking relationships have been shown between plant sap properties and saline content, pH soil values of the soil, and climatic factors, especially rainfall. The question of whether these relations also existed in the vegetation as the Wasatch Plateau scarp was ascended from 5,000 to 10,000 feet elevation, was the object of the study of the Great Basin branch station. It was thought there might be some relations established between cell sap characteristics, and plant succession and to the grazing value of forage plants.

These studies were only a part of a vast geographic series that Dr. Harris had under way. He had similar collections of data from Jamaica rain forests, Florida Everglades, Atlantic Coast, Utah deserts, Arizona deserts, and Hawaiian Islands. Of immense interest to the Intermountain Station were his studies in range areas of Utah, both on the mountain ranges and on the semidesert valley-bottom winter ranges. This field work had gone on through 10 years, three of which (1926, 1927, 1929) were partly cooperative with the Great Basin branch station. At the end of 1929, Dr. Harris regarded field work as complete and was preparing to begin summarizing his enormous sets of data, when he very suddenly died.

As a result of Dr. Stewart's trip, about 10,000 data figures were obtained from Dr. Harris's records. These, together with range management data on the plant species, will be tabulated and coded on punch cards for future study. Various scientists at Minnesota lent the most helpful cooperation, especially the committee in charge of Dr. Harris's records. Drs. R. A. Gortner, C. O. Rosendahl, and G. O. Burr were particularly helpful. Many suggestions as to how best to study the data were also obtained.

Chicago Meeting

Enroute to Minnesota, Stewart attended meetings of the American Society of Agronomy and Secretary Hyde's Conference on Land Utilization. The Land Utilization Conference was an assemblage of practically all men in the United States who were eminent in land studies. Secretary Hyde had in mind problems of cultivated agriculture, but public-land problems could not be kept out of the discussion. At the end of the 3-day conference, 18 recommendations were passed, of which Nos. 1, 2 and 7 are of great interest to the Forest Service and are given herewith:

Recommendation No. 1: Administration of public domain. It is recommended that in order to obtain conservation and rehabilitation of the grazing ranges of the public domain, these lands be organized into public ranges to be administered by a Federal agency in a manner similar to and in coordination with the national forests. Such public ranges should include lands withdrawn for minerals or for other purposes when the use of such lands for grazing is not inconsistent with the purposes of withdrawal.

Recommendation No. 2: Watershed Protection. It is recognized that throughout the Rocky Mountain regions and the Pacific Coastal region hundreds of communities are directly dependent on nearby watersheds for their supply of water for irrigation and other purposes and in many cases this dependence is interstate in scope due to the watersheds being in one state and the irrigation use in another state, and also due to the fact that the irrigation water of one state must often be stored in another state. Inasmuch as these facts cannot be changed, due to the geography of the region, it is recommended that lands valuable for watershed protection should be administered under the supervision of the federal government.

Recommendation No. 7: Homestead Interest. It is recommended that the several Homestead Acts be administered in the future with more careful supervision of land available for home making; that the lands opened for homestead entry be carefully classified at an early date and only those which after economic study promise a satisfactory standard of living be made available for entry. Lands classed as marginal or submarginal should be withdrawn from homestead entry and definitely added to the public range.

Erosion and Streamflow

Boise Erosion and Streamflow

Mr. Pearse is spending some time at the Utah State Agricultural College at Logan, Utah, where he will complete the analyses of a number of soil samples collected on the Boise river watershed in 1931. The information derived from these soil samples should assist in the reconstruction of soil profiles which it is believed have been altered in recent years by accelerated erosion. Dr. George Stewart initiated this investigation in 1930 and the samples taken in 1931 are for the purpose of checking the original work and of piecing together apparent gaps in the data.

Colorado River Erosion Survey

Field work on the survey of erosion conditions in the Upper Basin of the Colorado river watershed was closed down for this season on November 12. At this time the extensive survey is practically completed for

the areas in Wyoming and Colorado, and the greater part of Utah, though some further field work will be necessary on the San Rafael, Fremont, Escalante, and Paria rivers in southern Utah. A preliminary report on the findings is practically completed.

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LAKE STATES FOREST EXPERIMENT STATION

MARCH - DECEMBER

During the period for which the Station submitted no regular monthly report there occurred only a few events that may be of interest to other Stations.

Two experimental forests on the Chippewa and one experimental area on the Superior were recommended jointly by the Regional Forester and the Director for formal approval by the Forester.

A new branch station has been established in North Dakota with headquarters at Towner. Locally this area, which is maintained in cooperation with the North Dakota School of Forestry, is known as the Den-high Dunes Experimental Forest.

A soil erosion station was established near La Crosse, Wisconsin, in cooperation with the Bureau of Soils, Agricultural Engineering, Forest Service and the University of Wisconsin.

These new activities made a heavy demand upon some of the field men for planning and supervising different constructions.

Since last spring, the Station has been enriched by four new buildings, several field laboratories, and a greenhouse unit on the University Farm Campus.

The permanent technical staff has been increased from ten to sixteen men.

The spring and summer in the entire region was characteristically dry and was accompanied by hot dry winds which unfavorably affected the experiments involving planting or seeding, but, on the other hand, the drought brought out new relationships between plants, soil moisture and air humidity which could not be obtained in normal years.

Very few of the silvicultural projects have reached any final stage that would justify early publication. The correlation between soils and forest types which has been carried on for the last two years by Kittredge

is completed as far as field work goes, but unfortunately his leaving the Station for the forest school in California may delay the working up of the field data and the preparation of the manuscript for another year.

The Station has completed three studies during the summer of which two, "The Logging Slash and Forest Protection" and "Forest Fires in Michigan", were published by the Agricultural Experiment Station of Wisconsin and the Michigan Conservation Commission, respectively, and the third, "Light and Plant Growth in a Virgin Norway Pine Forest", is coming out as a contribution to the Journal of Agricultural Research.

In the field of economic studies several phases of the project have been completed and will probably be printed locally in cooperation with the Universities of Minnesota and Wisconsin.

Manuscript of "The Forest Crop Law in Practice in Wisconsin" has been completed but is being tested in crucible of divergent opinions. Our forest survey of Washburn County, Wisconsin, is to appear as a part of the County survey series of the Wisconsin Agricultural Experiment Station, and last year's results of the study of the New Public Domain in Minnesota is also completed and will appear as a chapter of the comprehensive investigation of the entire problem of taxation in the state.

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NORTHERN ROCKY MTN. FOREST AND RANGE

EXPERIMENT STATION

The big project was that of making arrangements and preparation for the Annual Investigative Council meeting, which was held on January 4, 5, and 6 at Missoula. The attendance, due to recent expansion of work, was larger than usual. We have not recovered from the strain sufficiently, as yet, to really fix in our minds the significant features of the meeting; hence details will have to hold over until next month. There seemed to be general agreement that a real stride forward was taken in the question of land management as applied particularly to eastern Montana. No small part of the success of this phase of the meeting goes to the active participation on the part of the Montana Agricultural Experiment Station, the Milwaukee Railroad, and several informed stockmen.

Analysis of the Fire Records

Summarization of the machine tabulations of the fire data was continued throughout December by one clerk, neither Gisborne nor Hornby being able to give more than supervisory time to this work. An experienced

clerk, however, is able to summarize the data from the machine tapes very rapidly, producing detailed statements based on thousands of reports at the rate of a final table every one or two days:

One interesting finding from data never before compiled in this Region consisted of the following:

Location of fire in seen or un- seen area from lookout making first discovery	Average discovery time for all fires discovered within 48 hours	Final area burned. Average per fire.	Suppres- sion cost. Average per fire.	Average discovery distance	No. of fires basis
	Hours	Acres	\$	Miles	No.
Seen	5.5	92	331	5.5	2918
Unseen	9.2	207	792	5.5	1417

Measuring Forest Fire Danger

During December one result of our recent fire studies, which had been released to the Service as an item in the September 28 issue of the Service Bulletin, was further disseminated by C. L. Billings, manager of the Clearwater Timber Company, and by the press service of the University of Idaho. The original item had been prepared especially to stress the effect of crown fires in exposing an area to greater drying and inflammability. Mr. Billings used the data to stress the more deleterious effects of clear cutting compared to selection cutting and the retention of a residual stand.

The data published in the Service Bulletin showed that clear cutting or clean burning resulted in raising the average maximum temperature of the air about 6° during the period June 21 to August 20, 1931; that the average 5:00 p.m. relative humidity was decreased about 10%; that the average maximum temperature of the surface of the duff was raised from 75° under timber to 122° F. in the open, while the absolute maximum under a complete canopy was 85°, and in the open 148° F.; that minimum duff moisture content was changed from 17% to only 4%, while two-inch diameter slash had its moisture cut in half, from 10% to 5%. Obviously, the results of partial cutting would not produce such extreme changes as these. Fortunately, however, we have complete measurements in a selectively cut area so that these intermediate results can be determined and a more detailed statement prepared for the information of both private forest owners and the Forest Service.

Lightning Study

Coding of the lightning storm reports for 1931 was completed in December by Hugh Redding of the Regional Office, whose services were contributed to this work. As we had decreased the number of lookouts used in this study, in order to employ only the best stations where the best men are supposed to be placed, we had expected a decided improvement in the average quality of the lookout observations. Redding has rated separately the reports from the 115 lookouts used last year, with the result that 5% are classified as excellent, 45% good, 27% fair, and 23% poor. In a season as important as that of 1931, for which we wish to determine accurately the frequency of thunderstorms as compared to other years, it is unfortunate that a carefully selected list of lookouts should have failed to provide the simple information needed. It should be recognized, however, that during 1931, especially the latter half of the season when most of the storms occurred, the lookouts were kept busier than ever before in taking azimuths on lightning strikes and chasing new smokes.

Compilation of Weather Records

Compilation of 20 years of weather records of the Priest River Branch was continued during the month by Timison. Weather data for December have been received completing the records for the twentieth year. Summaries have been started, and the analysis will be completed soon.

Range Studies

Hurtt spent three days early in December at Helena with his successor on administrative work. The month was spent on current work and preparation of a paper to be read at Spokane, and in outlining a desirable Range Research program that was presented in early January before the Investigation Committee. Several invited stockmen and others interested in the industry attended and gave counsel on the needs.

Silvicultural Studies

Over thirteen hundred reproduction quadrats in the western white pine type are now five years old, and the results of annual and semi-annual examinations are being compiled this winter. One of the striking findings of the work to date is offered by the parallel screened and unscreened quadrats. These installations were made following the heavy seed crop of 1926 and following also the subsequent removal of most of the stand by either logging or forest fire. Except for two or three unusual accidents, the screened covers and sides effectively prevented the entrance of seed to the protected spots after installation. The result

in number of seedlings per acre which germinated is shown in the following table covering about four hundred quadrats:

Number of Western White Pine Seedlings Started Per Acre

	Plot 129		Plot 132		Plot 133		Plot 134		Plot 135	
	Un-		Un-		Un-		Un-		Un-	
Year	Scr.	scr.	Scr.	scr.	Scr.	scr.	Scr.	scr.	Scr.	scr.
1927	1000	667	4200	1842	9888	12142	222	833	2200	1400
1928	333	278	634	492	4154	4812	1111	500	200	300
1929	0	56	66	192	0	354	0	56	0	150
1930	0	111	0	108	62	254	0	500	0	50
1931	133	139	0	108	0	146	0	333	0	400

The two facts of vital importance indicated by this series of plots is (1) that on cut or burned over areas western white pine seed germinates entirely in the first two years after being shed, and (2) that seed trees after cutting may be expected to start a small but dependable amount of reproduction each year, which may amount to about 1 to 30 per cent (in the case of these plots) of that which starts following a good seed crop shed by the full overwood before logging.

As to the dependability of the basis for these deductions. The 1926 seed crop was heavy, and that of 1925 was light. Eighty per cent or more of the germination on Plots 129, 132 and 133 occurred on ground on which the duff was practically burned to mineral soil. It is a very safe conclusion, therefore, that all of the reproduction under the screens came from seed shed in the fall of 1926. Seed shed previous to that and stored in the duff played very little or no part whatever in the reproduction secured. A further check on these results is furnished by going experiments in which known quantities of seed have been stored in the duff protected by screening and taken up year by year and germinated in sand flats. In one set of tests the germination results so far are: 42.4% after one year's storage, 27.6% after two years, and 0.8% after three years. Another set of tests which has run only two years has given so far: 12.0% after one year and 31.0% after two years.

The values in the table clearly indicate, therefore, that seedlings from stored seed and from seed shed in the same year as the logging operation will germinate within two years after the cutting. Any seedlings germinating after this two-year period can be attributed almost entirely to subsequent seeding from live trees left on or adjacent to the cutover area. An analysis of the age of reproduction present on some 27 typical cutover areas in the white pine type, examined ten years or more after logging, shows quite conclusively that the great majority of established seedlings present originated after the third season. Subsequent seeding, therefore, and not stored seed has been the main and most important source of seed in the western white pine type. Indeed, if at least 500

established western white pine seedlings per acre are considered essential to the success of a sale, then only 25 per cent of the Forest Service sales in the white pine type would have been successful if stored and coincident seeding alone had been depended upon.

The stored seed problem has been with us in the white pine type for some twenty years. It now seems possible for the first time to say on the basis of conclusive evidence that seed shed from seed trees or other seed source available after the logging, and not stored seed, has been the main source in supplying the seed necessary to restock logged-off lands in the western white pine type. Both stored and coincident seed play a part in reproducing these areas but subsequent seed has played by far the dominant role. Without subsequent seeding the majority of white pine cuttings would not have reproduced satisfactorily.

Although the table here given shows ample reproduction resulting from seeding before logging and fire in all five cases cited, the heavy seed crop of 1926 and the moist growing season of 1927 favorable to survival gave rise to much better results than usual in this respect. The more representative condition is shown by the cutover area studies in which the areas investigated had been cut in different years and under a wide spread of seed crop and establishment conditions, and in which over 75 per cent of the cases showed less than an adequate amount of reproduction started as a result of seeding before logging.

Wood Preservation

Mr. Whitney analyzed the results of the 1931 inspection of the King's Hill telephone line project during the past month. This project contains 774 treated and 94 untreated poles. The following tabulation gives the results of this study to date:

TREATING CONDITIONS AND RESULTS WITH VARIOUS FORMS OF ANACONDA WOOD PRESERVATIVE. (LODGEPOLE PINE AND DOUGLAS FIR POLES¹)

Preservative	No. of Poles Set	Date Set	Ap- prox. Years Serv- ice	Condition of Poles							
				Sound		Partly Decayed		Badly Decayed ³		Stubbed ⁴	
				No.	%	No.	%	No.	%	No.	%
5 Lbs. Arsenic Dust in Holes	238	Aug. Sept. 1926	5	64	26.9	55	23.1	110	46.2	9	3.8
Shaved and Arsenic Paste Applied 1928 After 3 yrs.		Fall									
Untreated	51	1925	6	5	9.8	8	15.7	30	58.8	8	15.7
5 Lbs. Granu- lated Arsenic in Holes ²	485	Summer 1927	4 $\frac{1}{4}$	30	6.2	166	34.2	234	48.3	55	11.3
TOTAL TREATED	774	-	-	99	12.8	229	29.6	374	48.3	72	9.3
UNTREATED	94	Summer 1927	4 $\frac{1}{4}$	3	3.2	3	3.2	88	93.6	0	-

¹ Approximately 40% of all poles treated were Douglas fir and 60% lodgepole pine.

² The arsenic was put in the holes in three layers, near the bottom, about the middle of the fill, and again just under the surface.

³ Poles in advanced and developed stages of decay to be stubbed in 1932.

⁴ Poles reinforced with creosoted lodgepole pine stubs in 1931.

If treater dust, or Anaconda wood preservative, has afforded any protection to these poles it is scarcely distinguishable in the above records. The rate of decay has been very rapid. Of the treated poles 72 were stubbed in 1931, and in addition 374 treated and 88 untreated poles should be stubbed in 1932. In other words, about 57% of all treated poles are shown to be in such poor condition as to require reinforcement after only four to six years of service. While one of the claims made for the treater dust or arsenic paste treatments is cheapness, an initial cost of 50¢ per pole for applying

such treatments to the poles in this line has not proved to be a good investment.

Approximately one-third of the lodgepole pine stubs needed for the maintenance of this telephone line in 1931 and 1932 were treated by District Ranger Wilson in 1931 at a cost of 59.4¢ per stub for the preservative and labor in treating. These stubs were treated with a 40 - 60 mixture of creosote and gas oil at the new King's Hill treating plant, Lewis & Clark Forest.

Logging and Milling Studies

Mr. Anderson spent some time during the month in starting Mr. Bloom compiling the L-DF selective logging study and on the log bucking for grade study. In the latter study, fire-damaged yellow pine butt logs were compared on a value basis with sound butt logs of a similar diameter, log grade and taper. From these data the loss from fire damage by tree d.b.h. classes were computed and applied to an average of two logging areas on the Flathead Indian Reservation. This stand contained 5.97 fire-damaged trees per acre, each suffering a loss of \$1.81 in lumber-selling value. The trees, sound or containing defects other than those due to fire, numbered 19.98 valued at \$19.25 each, based on average annual lumber-selling values for 1928. The average selling value loss per acre is then computed to be $5.97 \times \$1.81$, or \$10.78 per acre. This is not a theoretical loss, but a measurable loss caused by recurring fires during the past century or so. The importance and seriousness of this loss can best be illustrated by computing the loss sustained by a given logging unit.

The Camas logging unit on the Flathead Indian Reservation contains approximately 120 million feet of timber on about 12,000 acres. It is assumed that depreciation from fires during the past century or so has been the same on this area as on the Revais and Valley Creek units where the foregoing fire-damaged stand figures were obtained.

According to Forest Service and Timber Protective Association figures, 5¢ per acre over a long period will be ample for the best of fire protection, or a cost of \$600 per year for this area. The average yearly depreciation of this timber during the past century or so has been at the rate of \$10.78 per acre, or \$129,360 for an assumed period of 120 years. This period is used because available growth figures on residual stands indicate that cutover areas similar to those on Lynch Creek near Plains and the old A.C.M. cuttings surrounding Potomac will no doubt produce a volume equal to the yield of our present virgin stands in 120 years if given excellent fire protection. The average yearly depreciation of this timber during a 120-year period is then \$129,360 divided by 120, or \$1,078.00 per year. Thus, the annual net amount that could be saved by absolute protection would be \$1,078 - \$600, or \$478. This \$478, however, represents the horse that has already slipped out of the barn. Nevertheless, it illustrates one of the financial aspects in the protection of yellow pine cutover areas well-stocked with advanced growth.

Special

The first two lessons of the Regional correspondence course in Products were revised during the month. Eight members of the field force are enrolled in the course at this time.

Lumber Prices and Movement

	1st Q., 1931	2nd Q., 1931	3rd Q., 1931	October 1931	November 1931
Idaho White Pine	\$31.41	\$31.12	\$27.76	\$26.01	\$23.95
Western Yellow Pine	19.25	19.52	18.02	16.81	15.98
Larch-Fir	14.26	13.53	13.69	12.44	12.25
White Fir	13.76	13.82	11.04	10.65	10.46
Spruce	18.39	18.94	16.42	12.52	10.47

Shipment and Cut

1930

1931

Shipment

77,594

52,240

Cut

66,557

29,579

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Library

A progressive step has been taken in the organization and administration of our growing library. A separate room, centrally located, has been set up for this purpose, and Miss Frances Elliott, who has recently taken Miss Pinkston's place, has been placed in charge of the library. A library committee, consisting of McArdle, chairman, Lodewick, Cowlin, and Meyer, will function to supervise the filing, growth, and use of this important department of our work.

Section of Forest Products

Some preliminary studies were made of the theoretical yield of boards of different thicknesses from slabs of varying sizes. Several days were spent in a comparison of sawmill waste and its utilization in Finland, Sweden, British Columbia and the Pacific Northwest.

Forest Insurance

During December the study of losses by size classes was completed and office memoranda were written. This study involved the use of two sets of data from which it was possible, by analysis, to derive indications of the relative amounts of loss in the five established size classes. Data came from the field analyses of burned areas and from the supplementary individual fire reports furnished by the wardens last spring. The two processes of analysis are essentially parallel, and both sets of data carry a considerable amount of weight. The harmonizing of the results of the two processes, involving as it did careful weighing of the relative merits of the data, required painstaking consideration. It is believed though that the conclusions reached are sound and adequate for practical application in the rating process.

The climatic study report was rewritten for local distribution. Plans have also been definitely formulated for the holding of a meeting for discussion of the subject of climatic rating between interested agencies, including the State Foresters, Forest Service fire executives, the private protective organizations, fire insurance rating bureaus, and the technical fire students at the Station. This meeting is called for 10 a.m., January 5.

Forest Survey

Andrews and Corlin spent several days checking the field work in Coos County with Kline. Tax delinquency is rapidly becoming a serious problem in that county, and Kline pointed out several tracts of excellent second growth Douglas fir suitable for piling that can be purchased at very low figures, due to the pressure of taxation and the inability of the owners to see the future values. These stands were on Site II lands, usually well to medium stocked and accessible to tide-water and highways. A minimum application of forest management would suffice on these lands, as they are in a thrifty condition, easily protected, and will at this time yield a crop of poles, piling or tie timber. The presence of Port Orford cedar in this county with its high values and opportunities for substantial profits has tended to depreciate Douglas fir in the local timber market, and timber speculators and operators pass over the Douglas fir stands in their search for Port Orford cedar.

Matthews went to Eugene to check over with M. L. Holst his completed records of the timber inventory of the Cascade Forest. Holst will be returned to the Regional organization and pay roll effective January 1, and is the first man to be returned to the administrative organization from an assignment on the survey, although there will be several others released before July of this year.

Andrews and Matthews presented a sample type map of a section of a forest to the Forest Management committee of the Supervisor's Meeting in order to secure from them an expression of opinion as to the form for final presentation of the forest type data and summaries that will best serve the needs of the national forest organization. For national forest areas it is now the plan to take the one-inch-to-the-mile national forest base maps, ink in the type boundaries and type numbers and make Van Dykes, from which any number of blue line prints showing both base and type data can be printed. Anyone having one of these maps and a type legend can then color the map for himself. This will make it possible for the forests to supply fire dispatchers, rangers, firemen, and others with as many copies of the type map as they desire at a small cost, because once the Van Dyke is made, the reproduction of the type map in quantity is just a matter of blue printing.

Fire Studies

Reporting and Charting Lightning Storms

Further study of the lightning storm data for the years 1925-1930 inclusive, has substantiated our previous statement that thunderstorm conditions rarely move across the Columbia River in the Cascade Range, even though the storms may have come from a point 150 miles to the south. It has also been found that of 23 storms which were seen moving from the Paulina Mountains and the Fremont National Forest toward the near-by Blue Mountain area in eastern Oregon, only three storms crossed the intervening desert-like country. Some authorities have stated that lightning storms in the southern part of the Oregon Cascades are usually forerunners of storms which affect the northern and northeastern Oregon sections on the succeeding two days. A careful study of our data does not give any support to this contention.

The Time Factor in Fire Control

The speed of attack, or "hour control" studies continue. Analyses for the Columbia, Rainier, Snoqualmie, Siuslaw, Mt. Baker, and for part of the Olympic Forest were completed during the month. These analyses for forests west of the Cascade Range are resulting in an entirely different picture than was obtained with similar analyses for the forests east of the Cascades. Striking differences are again being found between individual forests. The Region 6 supervisors at their recent meeting discussed the hour control study at some length and gave their enthusiastic approval to the method and manner of conducting the study in this region. They were especially in favor of having the actual work of the analyses done by men from the individual forests.

Static and Lightning Storms

Analyses are completed and it is expected that a full report can be made on this study some time next month. As indicated last month, we have found no evidence that static, as we have been measuring it, can be used to obtain warning of the building up of thunderstorms. Static can be used very successfully to detect the presence of distant storms actually in progress.

Silviculture

Douglas Fir Natural Reproduction Studies

Douglas Fir Natural Reproduction Studies were confined to office computations as some of Isaac's time was taken up by the Supervisor's Meeting and later in the month he was on leave.

To obtain natural restocking at an early date, there has been a general trend toward leaving unburned parts of Douglas fir cut-over areas where slash was light and hazard low. The development of this practice aroused some lively discussion at the Supervisor's Meeting, some holding that heavy fire losses occurred because of this practice. However, it was quite definitely brought out by both the members of the Experiment Station and by Supervisors that the only reason for slash burning is to reduce the fire hazard, and where heavy losses have been sustained, it was because large continuous areas of heavy slash were left instead of small areas of low hazard as is advocated. In the end it was voted that it be left to the judgment of the supervisor if areas of low hazard should be left unburned on his timber sales. The movement to eliminate the single seed tree and leave in its place strips of green timber that aid in fire protection as well as furnish a source of seed was received with enthusiasm.

Methods of Cutting in Western Yellow Pine

The computing being done by Kolbe on this project was interrupted due to his absence. On a number of plots the computing is complete, and the necessary tables and charts have been prepared. Three progress reports will be finished at an early date.

Mensuration

The month was spent by Meyer and several computing assistants in preparing over 2600 tapers of Douglas fir and in reading off their cubic foot and board foot volumes to several degrees of utilization, so that in the near future this material could be combined with data from other regions to form a set of volume tables which will apply to the entire Douglas fir region.

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SOUTHERN FOREST EXPERIMENT STATION

Forest Survey

Granger, Girard, and Schumacher spent the first part of the month in the south, conferring on the Hardwood Working Plan - a rough draft of which has gone to Washington for criticism. The principal change in the final plan is that lines will be run 10 miles apart instead of 3, the distance used in the preliminary survey. More sample trees will be taken for log grades and growth figures.

The preliminary pine survey continued in Pearl River County, Mississippi. The office compilation was started by Davis and Putnam and the office procedure plan revised somewhat. Field work was hindered considerably by continuous heavy rains and was discontinued December 23rd.

Hardwood Growth and Yield

Field work was begun on the growth and yield study of even aged red gum stands. The first few weeks work indicated that drainage and soil character are important factors in site determination. The poorest sites were characterized by high water table and stiff clay soils.

New Public Domain

Assistant Forest Economist R. B. Craig reported for duty early in December and started work on a new study dealing with tax delinquent lands. He immediately got into the field and obtained tax data and sized up the situation in several counties in southern Mississippi.

Forestation

At Camp Pinchot six additional seeding and planting tests with pine were started. Some 50 species of native and exotic species were planted in the new arboratum.

Naval Stores

Dry facing began to show up in some of the daily chipped trees, so 20 trees in this group will be rested from December 12th to March 15th, 1932. The progress report on the chipping frequency test has been nearly completed by Olsen.

Management

The report on fire and brown spot damage in the national reproduction in the 10,000 acre South Pasture at Bogalusa has been nearly completed by Wakeley and a base map of the pasture has been prepared.

Wahlenberg visited Camp Pinchot, Olustee and Penney Farms, Florida, to get in touch with the forestation and grazing studies in those localities. These studies promise to supplement the McNeill project and are carried on cooperatively by the Animal Husbandry Department of the University of Florida, the Florida Forest Service and Penney Farms.

Economics

Field work was completed in Union Parish, Louisiana, study. Office work continued on the Beaufort County, North Carolina, Polk County, Texas and Hempstead County, Arkansas, reports. A paper on the "Financial Aspects of Growing Pine in the South" was read by Bond at the Second Arkansas Extension School, at Camden, Arkansas.

Erosion

Run-off plots were reestablished and plans for the installation of large tanks were prepared at Holly Springs.

Olustee

Natural reproduction study plots, burned, ploughed and rough, were laid out on the Osceola Forest. Progress was made on a management plan for the Olustee Experimental Forest. Work was continued on the type and density maps for the area and a start was made on a contour map of Section 29.

Pathology

The 1931 figures of seedling heights in the brown spot sprayed and check plots were worked up. A paper for publication dealing with brown spot was prepared by Siggers and the data gathered on the extensive survey of brown spot was compiled.

In the forest products pathology work much deterioration due to decay showed up in sap gum stored in yards for $1\frac{1}{2}$ to 2 years with less marked losses in other species.

Rubber gloves seemed necessary to protect workmen handling mercury dipping compounds. Improvement is being made in the preparation of Lignasan for stain prevention.

Data collected on fire and decay in young hardwood stands are being summarized in a report.

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SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

Sample Plots

Compilations recently completed by Krauch have yielded data for the tables given below. The first presents increment and mortality in Western yellow pine cut under different methods on the Coconino and Tusayan national forests.

Plot	Method of Cutting	Area of Plot acres	Length of record years	Volume* per A left Ft.B.M.	Net Annual increment per A Ft.B.M.	Mortality per A Ft.B.M.
					%	%
S3	Group Selection	456	20	3520	91	2.59
S4	do	304	20	2528	67	2.88
S5-I	do	139	15	2846	79	2.77
S5-II	Scattered Seed Tree	152	15	1873	30	1.60
S-5-III:Shelterwood:		112	15	4510	93	2.06

*All board foot volumes are according to the Scribner log scale including only trees 12 inches or over d.b.h.

Mortality as a factor in increment deserves special consideration. It is obvious that yield tables based on accretion cores without allowing for mortality would be greatly in error. The main causes of death are wind-fall, lightning, and mistletoe. Mortality, along with the low growing stock, accounts for the low increment on the scattered seed tree area. Lightning has been particularly destructive in this stand. Practically the same number of large trees have been struck here as on the shelterwood area where the number of large trees per acre is much greater, and thus the percentage of volume loss becomes relatively much higher in the scattered seed tree cutting.

The table below gives diameter growth in broad diameter classes. "Yellow Pine" and "Black Jack" are separated because they represent a great difference in age and general vigor.

Black Jack - Age up to about 180 years.

Trees measured on					Mean annual diameter				
different plots					growth on different plots				
Classes	S1,S2,S3:	S5-I:	S5-II:	S5-III:	S1,S2,S3	S5-I	S5-II	S5-III	
Inches	No.	No.	No.	No.	Inches	Inches	Inches	Inches	
4 - 11	392	1284	619	1022	.142	.194	.273	.171	
12 - 20	434	1133	220	899	.150	.202	.248	.191	
21 - 30	101	193	120	121	.146	.171	.240	.194	

Yellow Pine - Age over 180 years

12-20	No	77	27	104	No	.148	.200	.148
21-30	record	187	122	305	record	.137	.164	.135
31-40		22	49	53		.129	.160	.131

Records for plots S1, S2, and S3 cover a period of 20 years (1909-1929); records for Plots S5-I, II, and III cover a period of 10 years (1913-23).

In the "Black Jack" age-class diameter growth declines but little with increasing size. This relation is contrary to that generally prevailing in other regions, and may be attributed to incomplete stocking, which would permit expansion of root and crown area with increase in diameter of the bole. Although the "Yellow Pines" fall off somewhat in the higher diameter classes, many individuals over 30 inches dbh. are growing as fast in diameter as those below 20 inches. Few of the large trees are crowded for growing space, and where they fall off in growth it is probably due to a decline of vigor, as is often noticeable in the appearance of the crown.

Thinnings in Western Yellow Pine

A series of six thinning plots, including two unthinned controls, was established with the aid of the ranger training camp at Fort Valley in the fall of 1926. These plots were remeasured in the fall of 1931. In general, the thinning was from below, but not entirely so because the

stands contained considerable numbers of mistletoe infected, porcupine damaged or otherwise undesirable trees in the dominant and co-dominant classes. All of the plots have responded except one which was very densely stocked originally, and evidently the trees have not had time to develop good crowns and extend their roots. The greatest response is in trees below 6 inches dbh. Above this size diameter growth has been almost as great on the unthinned as on the thinned plots, suggesting that the larger trees in the dominant class may make good growth without thinning. Since this finding is based on only 5 years of record, it should be regarded as distinctly tentative.

Jornada Experimental Range

The State College field day, held December 4 at the College ranch which adjoins the Jornada on the west, was a decided success and was attended by a large crowd of interested stockmen from all over the state. They served a barbecue dinner which, of course, was of special interest to all, and after lunch the program began with an interesting and comprehensive lecture by Canfield, illustrated by charts prepared from the results of five years' study of the clipping of Black Grama grass during the growing seasons. He was followed by Professor Lantow of the State College, who delivered an illustrated lecture on the use of mineralized salt by cattle. He demonstrated first by charts what he had been able to accomplish with the use of salt containing Hypo-phosphates during the current year, in that cows and calves showed a surprising increase in weight, the mortality among cows at calving time was practically eliminated and many other very beneficial results, together with cost data. He also showed results of various feeding experiments with corn and cotton seed cake. After his lecture, the visitors were invited to drive over to New Well where he had, for comparative purposes, a bunch of the cows and calves with which the mineralized salt experiment had been carried out, in one corral and a bunch in another which had used ordinary range salt. The comparison was striking and obvious even to a tenderfoot who never before saw a cow, and certainly went over big with the cowmen, judging from the comments and the inquiries received by Lantow as to the cost and availability of the special salt. The meeting was attended by a number of Forest officers, those present being: D. A. Shoemaker from the R. O., Supervisor Adams of the Cibola, Supervisor Scott, Deputy Supervisor Lessel, Grazing Examiner Boone, and Ranger Wang from the Gila, Supervisor Arthur, Deputy Supervisor Morris and Rangers Laney, Boone and Galt of the Lincoln, and Ares and Canfield from the Jornada.

The stormy weather at the beginning of the month brought the Jornada an unusual visitor. Pilot Earle Campbell, who has been flying one of the W. A. E. mail and passenger planes on this route for the past two years, with two officials of the company, was forced down here on the afternoon of December 1 by the low visibility due to fog and driving snow. He circled the place at low altitude, making a perfect landing near the ranch and taxied up to the corrals where we staked the ship. He was

afraid to continue on to El Paso, his destination, so they spent the night at the Station. They had a rather interesting day of it, starting from El Paso at an early hour to hunt for another missing pilot and after finding him in a damaged ship, they flew him back to the airport and left on the regular schedule for Albuquerque. Before reaching Socorro, they ran into snow squalls and decided to turn back, and on the way had to make a forced landing on a rough field near Engle. After a short time the weather cleared a bit, and they left only to be forced down here a short time later. The next morning before they left, the pilot made a survey of the terrain in the vicinity of the station, with a view to selecting the most favorable site for future use, as he stated that he expected to make use of it any time he got into thick weather or other trouble in this vicinity.

Mr. W. H. Waggoner, the cooperater here, has so far been unable to dispose of his 1931 calves. He plans to wean them all in January and winter them in the mountain pasture where there is considerable feed due to the protection and rest it has received for some time past. Another argument in favor of conservative stocking, for had he not surplus range, due to understocking in the past, he would either be compelled to sacrifice the entire calf crop on a slow market or pasture them somewhere at considerable expense until prices were more favorable. He shipped 50 yearling steers to El Paso December 12, where they were sold for \$4.50 cwt. They averaged 591 pounds in weight.

Stock are all in good shape and all the local cowmen say that prospects for a good winter and spring are better than they have been for years on account of so much fall and winter moisture and apparently, thus far, the stock has not suffered from the unusually cold weather we have had.

RESEARCH ACTIVITIES IN REGION 2.

During the first part of the month Roeser prepared working plans for two projects initiated during the past season in experiments which have for some time been included in the Experiment Station program. These projects, which were briefly described in the June and November reports respectively, are:

Block B, Gunnison Forest, in experiment Mt-103, for determining the rate of growth of lodgepole pine in the Pitkin region of Central Colorado following clear-cutting and different weights of selection cutting, and more specifically, to study the possibilities and silvicultural effects of thinning in second growth stands following clear-cutting.

Block J, Black Hills Forest, in experiment Mr-1, to determine the rate of reseed and progress of natural reproduction, also the possibility of re-establishing the stand by direct seeding, in the Black Hills western yellow pine type under severe conditions of forest destruction occasioned by fire (in this case, the 20,000 acre Rochford fire of September, 1931).

The thinning study in lodgepole pine on the Gunnison really constitutes a continuation of the experiment initiated in 1913 to determine the effect of various silvicultural methods upon the rate and character of natural reproduction (Mc-103) which was concluded in 1926. The new project takes up where the other left off. Preliminary observations, as interpreted from borings made in the 190 trees per acre left in the selection cutting, show an average diameter increase of 1.11 inches in 20 years since cutting as against a .35 inch rate of accretion in 10 years immediately prior to cutting. These figures are for a 200 year old pole stand ranging between 3 and 10 inches d.b.h. The fact that such stimulation is possible, where the growing conditions are favorable, materially enhances the prospect of harvesting a second-cut of trees within a reasonable period following an original partial cut. The advantage of increased growth, however, appears to be offset by the rather meagre and patchy reproduction coming in under the residual stand which hardly guarantees a normally-stocked second growth stand.

In addition to these working plans, the manuscript on the resistance of coniferous seedlings to excessive heat was rewritten and submitted to the Journal of Forestry for publication.

On December 11, Junior Forester M. L. Smith, who had been stationed at the Fremont Field Station to handle the routine weather and type study observations during the absence of M. L. Williamson, took annual leave for the balance of the year. Prior to the end of the month, he was transferred to the Washington Office on a temporary detail to price projects work in the Branch of Research. While at Fremont, he spent considerable time in computing the 1930 soil moisture data for the various field stations in the type study.

Williamson returned to duty at Fremont on December 15. In the interim, Roeser bridged the gap at the Station between Smith's leaving and Williamson's return. During this four-day period his time was largely occupied with threshing the cone lots collected last fall in the Douglas fir and western yellow pine seed production studies, and in the Nebraska and Fremont seed source experiments. One phase of the western yellow pine seed production study involves a series of observations on the chronological development of individual cones from the time the flower buds open until the cones mature, including a study of the amount, character, and viability of the resultant seed crop. The data, relating to the 1931 cone crop, herewith briefly summarized, offer some information on the periodic growth and mortality rates of the developing cone crop.

Date of observation	1930					1931		
	7/2	8/4	9/11	5/16	6/6	7/7	8/7	9/6
Number of living cones	93	79	69	69	68	64	64	61
Percentage of survival	100.0	84.9	74.2	74.2	73.1	68.8	68.8	65.9
Average length of living cones (ms)	13.9	19.4	21.4	24.7	30.9	59.1	65.7	66.6
Relative degree of development based on percentage of complete size attained	20.8	29.2	32.1	37.1	46.4	88.8	98.6	100.0

The July 2, 1930 count represents the flower crop within a few days after emergence. It will be seen that there is a progressive loss in the cone crop both before and after fertilization. Surprisingly enough, there was no winter loss. The maximum period of increase in size occurred at the beginning of the second growing season, approximately during the time of fertilization.

Additional information was obtained on the fate of the 1931 Douglas fir flower crop after the results of the various observations were analyzed. The total absence of a flower crop above approximately 8,500 feet elevation was mentioned in a previous report and was attributed largely to the species' excessive activity in producing vegetative buds, following the complete destruction of the bud crop in the winter of 1929-30 and the almost complete failure of growth the following season. During the past spring as many as 15 buds were counted in one terminal cluster, and in one case, 25 buds were found massed on the upper 1-3/4 inches of the twig. Such conditions are of very rare occurrence.

The average flower crop per tree from the lower limit of the range of Douglas fir (about 7,000 feet) to about 8,500 feet elevation amounted to about 455 flowers. The percentage of mortality was 94.1%. 92.7% of this destruction was directly attributable to freezing in the severe spring storm of May 22 to 25. The peculiar habit of Douglas fir to flower from 4 to 7 weeks in advance of the other indigenous coniferous species with which it associates in the face of recurrent heavy loss through freezing is hard to account for.

The last half of the month was spent by Roeser in writing up the project memorandums for the annual investigative report, which task was just about complete as the first of the year came around.

The year 1931 was a very dry one in the Central Rocky Mountain territory, especially during the latter half. The total precipitation for the year at Fremont was 19.22 inches, more than 4 inches below normal. Heavy

rainfall in May and June saved the situation, so far as forest growth for the year was concerned. The past December, with .04 inches of precipitation, proved to be the driest in the history of the local weather station.

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MANUSCRIPTS

PACIFIC NORTHWEST

- Munger, T. T. "The Need for Research in Forestry Practice."
(Paper for the Washington State Forestry Conference)
- Shepard, H. B. "The Influence of Local Climate on Forest Fire Hazard in the Douglas Fir Region."
(Mineographed Report)
- Kemp, P. D. "Descriptive Memoranda of Forest Survey Field Work and General Conditions in Lincoln County, Ore."
- Buell, E. D. "Descriptive Memoranda of Forest Survey Field Work and General Conditions in Pacific County, Oregon."

APPALACHIAN

- Simms, I. H. "Establishment and Survival of Yellow Poplar Following a Clear-cutting in the Southern Appalachians." (For Jour. of Forestry).

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IN PRINT

- Abell, C. A. How to make photographs identify themselves.
(Forest Worker, November, 1931)
- Averell, J. L. Forest people: A canner turns tree grower.
(Am. Forests, November, 1931)
- Buell, J. H. Pisgah aids the unemployed. (Amer. For., December, 1931).

- Burleigh, T. D. Bird Life in the Great Smokies
 (Asheville Citizen-Times)
- December 6 - Woodpeckers of the Great Smokies.
 " 13 - Thrushes of the Great Smokies.
- Gisborne, H. T. Phases of fire problem. (Amer. Lumberman,
 November 28, 1931).
- Hodgson, Allen R. The present utilization of sawmill 'waste'
 in the Douglas Fir region. (The Timberman.)
- Haig, I. T. Stand tables for second growth western white
 pine. (N. W. Science, December, 1931).
- Korstian, C. F. and Selective logging in the loblolly pine and
MacKinney, A. L. hardwood forests of the middle Atlantic
 (with Garver, R. D. coastal plain with special reference to
 and F. B. Cuno) Virginia. (Virginia Forest Service publica-
 tion No. 43, October, 1931.)

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FOREST TAXATION INQUIRY

The work on the comprehensive report and on the final revision of Progress Report No. 16 was continued. The title of the final edition of Progress Report No. 16 will be as follows: "Digest of Forest Tax Laws in the United States in Effect January 1, 1932". No field projects were undertaken.

Wager represented the Inquiry at the National Conference on Government held under the auspices of the National Municipal League at Buffalo, November 9 to 11, in order to keep in touch with the latest ideas on reorganization of local government and finance. He has prepared a draft of the section of the comprehensive report which deals with this subject in relation to forest taxation. Wager also attended in an unofficial capacity a Conference on County Government held at Columbia, Missouri, December 11 and 12. Although he is returning to his position at the University of North Carolina beginning in January, he will still be available for short assignments in connection with the completion of the comprehensive report.

Hall represented the Inquiry at the Conference on Land Utilization at Chicago, November 12 to 21, and has prepared an office report on the session which dealt with taxation.





